Columbia River CWR June 1, 2016 Workshop Summary

Summary Points from Discussion

Salmon and steelhead CWR use and behavior patterns in the Columbia River

- Chinook and steelhead generally migrate up the Columbia River near the shoreline but are still in the main current. Steelhead migrate at 3-5-meter depth and Chinook migrate deeper. Fish cross back and forth across the river where the channel narrows and at the base of the dams. As fish get closer to their natal stream, they generally will migrate along the side of the river of their natal stream confluence.

- Steelhead use many miles of the lower Deschutes River for CWR. Pit tag detections have demonstrated that "dip-in" steelhead use the Deschutes River as far up as Sherars Falls (70 rkm) and Pelton Dam (rkm 166). The Deschutes River, comprised the largest volume of cold water accessible to salmon and steelhead among the CWR tributaries above Bonneville Dam (e.g., relatively high amount of flow and depth, low gradient, no barriers). How far up "dip-in" steelhead go up other CWR tributaries is less clear. Most CWR use of the Wind River is in the confluence area. With the removal on Condit Dam on the White Salmon River, steelhead are documented above the old dam site, but how many are "dip-in" is unclear. The Pit tag detectors in the lower portion of the Wind and Klickitat Rivers can provide an indication of how many are travelling as far up as the detector locations. CWR use of the Little White Salmon is contained to Drano Lake due to an upstream barrier at the Hatchery just upstream from Drano Lake.

- Use of CWR below Bonneville Dam has not been studied. It is clear from fishing intensity that many steelhead and Chinook utilize the confluences of the Cowlitz, Lewis, and Kalama Rivers, but how much of this use is for CWR use is unclear.

- The scientific studies summarized in EPA's slides indicate steelhead begin to use CWR at a lower mainstem temperature threshold (19C) relative to Chinook (21C). However, differences in threshold temperatures are also influenced by migration data and life history timing (including spawning timing. Thus, this data is not an indicator of thermal tolerance per se.

- The scientific studies summarized in EPA's slides also indicate that steelhead use CWR to a greater extent than Chinook (80% vs 40% at 21-22C mainstem temperatures). However, the studies for which these data are based focused on tributary use and did not fully capture CWR use of the confluence plume area, which Chinook may be more prone to using because they prefer deeper water and may avoid the shallower tributaries. Thus, if Chinook CWR plume use was fully captured, a greater percentage of Chinook may use CWR areas than what is depicted in the literature.

- The group generally concurred with the potential difference in CWR use for Summer Chinook versus Fall Chinook. Summer Chinook migrate when mainstem temperatures are

rising, so any delay in CWR areas will result in warmer mainstem migration conditions. Conversely, Fall Chinook migrate when mainstem temperatures are falling, so they don't have this trade-off, but rather a benefit from migrating later. Plus, Fall Chinook bound for the Hanford Reach, lower Snake River, and lower tributaries typically have shorter overall migration distances compared to Summer Chinook bound for mid and upper Columbia and Snake River tributaries, thus may have lower costs associated with migration delay. Energetic content of fish entering the Columbia also differs between the early-maturing "Tules" and the later-maturing Columbia (Hanford Reach) "Upriver Brights" and may influence migration fitness and costs/benefits of CWR use.

- Tributary overshoot is common for steelhead in the Columbia River, which is described in the Draft Technical Report: Adult Steelhead Passage Behaviors and Survival in the FCRPS (Keefer, et.al. 2016). The majority of Steelhead that eventually spawn in Fifteenmile Creek, John Day River, and the Umatilla River overshoot these tributaries in the summer and proceed up the Columbia River passing one or more dams, then fallback and enter these tributaries in the fall/winter. This behavior appears to be related to temperature since steelhead generally do not overshoot the cooler tributaries (e.g., Deschutes, Wind River, Klickitat)

- The group concurred that sockeye generally do not use CWR in the Columbia River, or if they do, it's for short durations in the confluence areas of CWR tributaries. Sockeye seem driven to get their spawning grounds. The group agreed that since they migrate in early summer under increasing mainstem temperatures, if they hold for an extended period in CWR tributaries, they would encounter warmer mainstem temperatures than if they did not hold, which would be detrimental. Sockeye did enter CWR tributaries in 2015 (e.g., Drano Lake and Deschutes), but they were in poor shape due to warm mainstem temperatures and appeared to do so out of desperation and most died.

- Based on studies with temperature loggers inserted into fish, use of CWR in the Columbia River appears to be isolated to the cool tributaries. Studies with fish temperature loggers have not detected other potential sources or locations of CWR, such as groundwater inflow or in pools below the dams.

- It was noted that the "stray loss" in EPA's slides displaying NOAA conversion statistics could include dead fish associated with elevated temperatures as well as the percentage of stray fish that just get lost.

- It was hypothesized that aggregations of fish that use CWR may include a higher proportion of individuals that are weakened due to disease, stress, or other factors. Healthier fish may migrate through warm temperatures without needing to stop to use CWR.

- Fisherman say that when Fall Chinook arrive in August, they chase the steelhead out of the CWR areas.

Importance of CWR

- Members of the group had overarching concerns with the Columbia River mainstem temperatures being too warm and that was the fundamental temperature problem. And that focusing on CWR should not distract from mitigating mainstem temperatures, to the extent possible.

- There was acknowledgement of the pros and cons of CWR use. CWR could serve as ecological traps attracting fish in, which could result in increased harvest, delayed migration and associated mortality.

- The group, however, largely recognized that CWR is generally beneficial to reduce exposure to warm water temperatures, especially if harvest effects could be minimized. CWR use was viewed as most beneficial for Steelhead, some benefit to Fall Chinook, and to a lesser extent for Summer Chinook and Sockeye. Regarding the estimated 80,000 Steelhead using CWR on daily basis during late July and August, it was noted – "80,000 fish can't be wrong".

Sufficiency of CWR

- The group struggled with answering whether or not the current amount of CWR is sufficient. Many questioned whether the data was available to answer the question, such as data showing the difference in survival and egg viability for fish that use and don't use CWR. It was suggested to search the literature to help address this question.

- Whether or not there is sufficient CWR depends on the Columbia River temperature. Several scenarios were discussed: Columbia River temperatures attaining the 20C numeric criteria, current temperatures (warm years, cold years), and future conditions under Climate Change. The sufficiency question likely differs for each scenario.

- In addressing sufficiency, the question of how many fish can use a CWR area (i.e., density) was raised. It was noted there are density estimates from The Dallas Dam fish ladders in 2011 (60,000 fish a day in east ladder). It was also noted that observed density may have associated disease and mortality, so not necessarily ideal.

- Despite the unknowns and data gaps in understanding the importance and sufficiency of CWR, the group agreed that we should proceed with actions to protect and restore CWR. We can conduct studies and fill in gaps as we go, but we should not wait for all the answers to these questions, especially in light of Climate Change.

Additional Analysis and Studies

- Data from pit tag detectors in the lower reaches of the Wind, Hood, Klickitat, and Deschutes River, which are known CWR tributaries, could be analyzed to quantify CWR use.

- Additional pit tag detectors would be helpful to study CWR use. Drano Lake entry, White Salmon River, CWR tributaries downstream of Bonneville were noted as good candidate

locations.

- Comparing pit tag data from the Columbia mouth and at Bonneville Dam was noted as a possible approach to indirectly document CWR use below Bonneville Dam by comparing migration rates and temperature. However, it was questioned whether there would be sufficient detections at the Columbia mouth location for this analysis.

- To analyze fish density of CWR plume use, sonar or acoustic camera could be used.

- It was suggested to review literature on fish and temperature on studies in the Frazier and Klamath rivers, review degree days and effect on survival (although it was noted that these data only look fish that survived, so you're not accounting for the degree days of dead fish), and review Lisa Crozier's work on bio-energetics/vulnerability and egg quality declines with temperature.

Closing Statements

Chad Brown (WA DOE) - WA recognizes its role in this. From a WQS perspective, a lot to be gained from this study on the implementation side and what can be done. Why do all this work and not look at what habitat can be improved? Overall goal is good, include a separate chapter to address the specific question for the BiOp regarding sufficiency

Deb Sturdevant (ODEQ) – Interesting to see what's known and unknown. Still thinking about looking at it from fish use and benefit to fish and physical geomorphic potential. Two ways to come at it and merge the two. Not going to have all the answers, kind of have to use both aspects of it. Curious how this will work in the Willamette – simpler, fewer fish species. CWR use of fish in lower Willamette and how to get over the falls. In the Willamette, there are more feature-based refugia to look into. Want to know benefit it will provide, likelihood of success (restoration cost-benefit) and that it will persist.

Dan Rawding (WDFW) – Big picture – sufficiency question is vague, trying to understand how to answer that question. Great exchange of what we know about CWR use in Columbia River. Studies cited were not designed to answer the question that we're trying to ask, but we're piecing together. Didn't talk about information that exists outside of the Columbia (e.g., Fraser River sockeye, Klamath river). Literature review would be good. Like information on conceptual model. Don't think there's enough information to get at sufficiency question. Instead, what hypotheses can we test? Break this into a series of sub-questions. What is the effect of temp on conversion between Bonneville and McNary? What percentage of fish use CWR? That may be the best we can do. Now look at next steps and find gaps and fill them. Agree with future steps to protect CWR and what the cost benefit is.

Catherine Corbett (LCEP) – Lower Columbia – black box – little information on location of cold water refuges and fish use. Need future studies. Didn't talk about mainstem temp in lower Columbia, which is high and there is little that can be done to mitigate temperatures. By 2040, we'll regularly see 2015 temperatures. How do we deal with that? Higher temps and lower flows

– what can be done with CWR? Like a bandaid on a much bigger problem. Try to mitigate and start planning now with a smoother transition. Shouldn't wait. What was discussed today also applies to juveniles.

Joe Zendt (Yakama Nation) – Share deep concern on overall higher temps. Discussion on importance of habitats that there can be a lot done to characterize temps, tribs, and plumes, and what kind of actions can be recommended. A lot of concern on sockeye, but all species are important. Daunting scientific and policy actions. Use this to do coordinated research with this group. Agree with Dan's assessment. Want to look at what it will look like 10 years from now, not 20 years ago. Don't agree with not using juveniles.

Tom Iverson (Yakama Nation) - Need to do studies and need to do right away. Current state of knowledge is from studies with other goals. Don't focus on what it looked like 20 years ago but what it looks like now. Why don't we include juveniles in this effort?

Mike Langeslay (USACE) - Salmon need cold, clean water. We have a lot of information – don't know if there will be much better data set than now. What questions really need to be answered to protect and restore? Everyone agreed that for steelhead CWR is beneficial. Need better understanding of sufficiency. LCR is a black hole. Do a fly over and count boats August 1. Cost effective way of knowing where fish and CWR are.

Jeff Fryer (CRITFC) – Try to see if we can do pit tag detection at places if it's feasible. CWR important for steelhead, not sure about chinook and sockeye. Can sockeye move earlier? "a delayed sockeye is a dead sockeye." Run is incredibly early this year. Fish can adapt, but headwaters and spawning waters still need to be intact. Tribal gillnetters info – can work with CRITFC on that.

Carl Schreck (OSU) – Agree with what everyone has said. Don't lose sight that the quality of refuge depends on quality of fish using refuge. Didn't discuss contaminants, ocean feeding, genetics and didn't talk about those effects. Modeling will be useful to identify key unknowns. Difficult to figure out how modeling is used to dictate management measures. When fish are exposed to different variables, the response may not be linear or continuous.

Jason Dunham (USGS) – Good discussion. Presented and went over conceptual model (image below).

Pat Connolly (USGS) – Talked about data gaps but we are also data rich in this, but at same time, what can we pull off. Prioritizing gaps – what should be done next?

Krista Jones (USGS) - Concerned with habitat side of things There's another part of the year to look at habitat and look at holistic benefits, not just to benefit one part of the year and harm another.

Lynn Palensky (NWPCC) – Interested in 4-state Columbia Basin viewpoint. A lot of data gaps to fill along the way, but that shouldn't stop us from acting now. Council would be interested to

hear more about where these CWR are. If we can provide relief from human interactions this year, we should consider doing something now with what we know. Want to look ahead rather than look behind. Champion for whatever we need to do. Council would be interested in Matt Keefer's CWR work. Looking at increasing temperature modeling in mainstem and reservoirs, potentially even in 3-D mode.

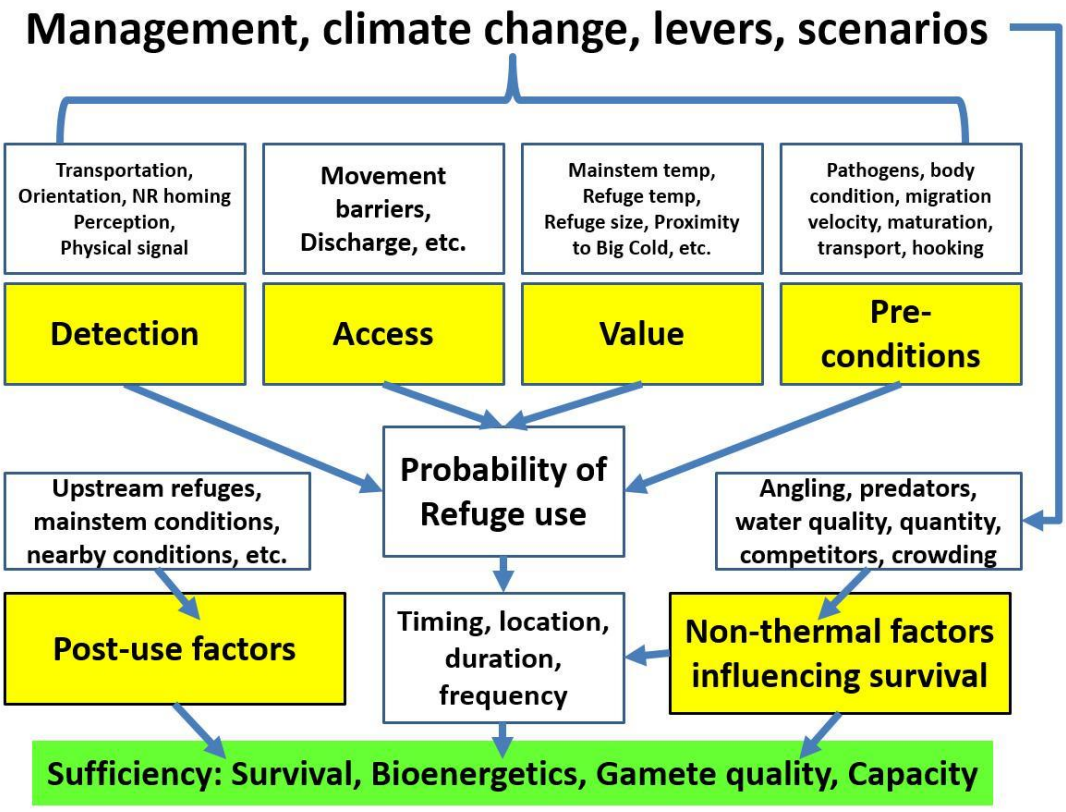
Margaret Filardo (Fish Passage Center) – See worth of identifying and protecting CWR. Dilemma when Columbia River temperature TMDL didn't go forward. Hope there's a way out. Not sure how it will all come together.

Matt Keefer (University of Idaho) – Sufficiency question. What do we think about it now? Different ways to frame questions going forward. Benefit of refuge use and nonuse… the effect may extend over several months (e.g., egg viability). That is a big gap. Think about ways to get at those questions. Look at other literature. Use "refuge" instead of "refugia."

Aimee Fullerton (NOAA Science Center) - Lot of things we can be critical about, useful exercise might be to take model home and work to define sufficiency and see what is left standing. Take what we do have and find and fill gaps.

Ritchie Graves (NOAA) – Agree with what's been said. Gratified that EPA is moving forward. Thermal refuges important for steelhead. Don't forget about the lower river and the Willamette.

Anne Mullen (NOAA) - Lower Willamette is habitat for upriver fish as well. Lower 50 miles because it gets over 20°C regularly. Black box above falls. Need more pit tag detectors and tags in fish. Where are fish dying before they get to the falls and get counted. Look at the mouths of the little tiny creeks, they may add up. Writing a lot of permits for impervious surface. Create storm water management plans. Runoff from impervious surfaces is stopping groundwater recharge.



Workshop Attendees:

NOAA – Ritchie Graves, Blane Bellerud, Bill Helvin, Anne Mullan, Aimee Fullerton
USACE – Mike Langeslay
USGS – Pat Connelly, Jason Dunham, Krista Jones, Tim Counihan
U of I – Matt Keefer
OSU – Carl Schreck
ODFW – Erick Van Dyke
WDFW – Dan Rawding
CRITFC – Jeff Fryer, Diane Barton, Casey Justice, Dale McCullough
LCEP – Catherine Corbett, Keith Marcoe, Chris Collins
Fish Passage Center – Margaret Filardo
NWPCC – Lynn Palensky
ODEQ – Debra Sturdevant
WDOE – Chad Brown
Yakama Nation – Joe Zendt, Tom Iverson
NOAA Coordinator – Nancy Schifferdecker
EPA – John Palmer, Dru Keenan, Joe Ebersole, Marylou Soscia, Rochelle Labiosa, Gretchen Hayslip, Jonnel Deacon, Jenny Wu, Christine Psyk, Peter Leinenbach